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## Identifying 2000 small and large creep events on the San Andreas Fault.

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The San Andreas fault has been observed to creep at the surface along the 175km section between San Juan Bautista and Cholame (Titus et al., 2011). This section is known as the creeping section and accumulates slip in two modes: during continuous background slip at a long term slip rate and in accelerated slip bursts known as creep events (Gladwin et al., 1994). But the size and importance of creep events remain unclear. Some researchers treat them as small, ~100-m-wide near-surface events (Gladwin et al., 1994), but others suggest that many creep events reach 4 km depth, connecting the surface to the seismogenic zone (Bilham et al., 2016). So, in this study, we systematically characterize the along-strike rupture extents of creep events along the San Andreas Fault, to determine if these are small, localized phenomena or large, segment-rupturing events.

We detect creep events and analyse their propagation using 18 USGS creepmeter records from the San Andreas Fault. Each creepmeter operated for at least 9 of the years between 1985 and 2020. To begin we systematically detect creep events using a cross-correlation approach. We identify periods that have significant slip and signals with high similarity to a template creep event. This automated detection allows us to produce a catalogue with 2000 creep events. The method detects at least 95% of the creep events identified by visual inspection.

Once we have found creep events at each creepmeter, we examine how creep events propagate. We compare creep event detections between pairs of creepmeters to determine how many creep events propagate from one creepmeter to the other. At the northern end of the creeping section, we observe that 18-28% of the creep events found at Harris Ranch are also found at Cienega Winery within 24hrs. This coincident timing implies that 18-28% of creep events in the north have an along-strike length of at least 4 km. Many creep events at the southern end of the creeping section appear to be even larger. For instance, a few events appear to be at least 31 km long; 10-38% of creep events at Slacks Canyon also observed at Work Ranch (31 km away) within 24hrs. These large along-strike rupture extents imply that creep events connect the slip and stress field over large regions of the San Andreas Fault. These events may play an important role in the slip dynamics of the creeping section.